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B. Desrochers, L. Jaulin

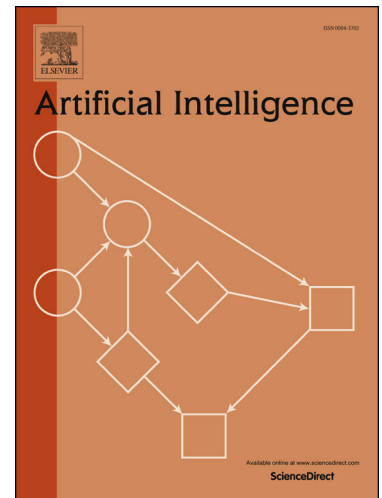
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Thick Set Inversion

B. Desrochers^{1,b}, L. Jaulin^b

^a*Direction Générale de l'Armement, Techniques Navales Brest, BCRM de Brest, 29240 Brest Cedex 9*

^b*Ensta Bretagne, LabSTICC, 2 rue François Verny, 29806 Brest*

Abstract

This paper deals with the set inversion problem $\mathbb{X} = \mathbf{f}^{-1}(\mathbb{Y})$ in the case where the function $\mathbf{f} : \mathbb{R}^n \rightarrow \mathbb{R}^m$ and the set \mathbb{Y} are both uncertain. The uncertainty is treated under the form of intervals. More precisely, for all \mathbf{x} , $\mathbf{f}(\mathbf{x})$ is inside the box $[\mathbf{f}](\mathbf{x})$ and the uncertain set \mathbb{Y} is bracketed between an inner set \mathbb{Y}^{\subset} and an outer set \mathbb{Y}^{\supset} . The introduction of new tools such as *thick intervals* and *thick boxes* will allow us to propose an efficient algorithm that handles the uncertainty of sets in an elegant and efficient manner. Some elementary test-cases that cannot be handled easily and properly by existing methods show the efficiency of the approach.

Keywords: Set-Membership methods, Interval Analysis, Constraint programming, Uncertainty.

1. Introduction

Interval-based methods [1, 2] combined with constraint propagation [3, 4, 5] have been shown to be very efficient to deal with continuous constraint satisfaction problems (see, *e.g.*, [6, 7, 8]) and global optimization [9]. A specific and important constraint satisfaction problem is *set inversion* [10] which can also be interpreted as the inversion of a set-membership constraint [11]. Given a function $\mathbf{f} : \mathbb{R}^n \rightarrow \mathbb{R}^m$ and a set $\mathbb{Y} \subset \mathbb{R}^m$, set inversion aims at bracketing from inside and outside the set

$$\mathbb{X} = \mathbf{f}^{-1}(\mathbb{Y}). \quad (1)$$

Email addresses: benoit.desrochers@ensta-bretagne.org (B. Desrochers), luc.jaulin@ensta-bretagne.fr (L. Jaulin)

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